IDENTIFICATION OF RETINAL DISEASE USING BLOOD VESSEL EXTRACTION

A Mini Project Report

submitted by

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to

the APJ Abdul Kalam Technological University
in partial fulfillment of the requirements for the award of the Degree

of

Master of Computer Applications

Department of Computer Applications

MES College of Engineering
Kuttippuram, Malappuram - 679 582

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DECLARATION

I undersigned hereby declare that the project report **identification of retinal disease using blood vessel extraction**, submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Applications of the APJ Abdul Kalam Technological University, Kerala, is a bona fide work done by me under supervision of Mr.Balachandran K P, Associate Professor, Department of Computer Applications. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Place: KUTTIPPURAM

Date:25/02/2022

AMRUTHA VV[MES20MCA-2007]

DEPARTMENT OF COMPUTER APPLICATIONS
MES COLLEGE OF ENGINEERING, KUTTIPPURAM

CERTIFICATE

This is to certify that the report entitled **identification of retinal disease using blood vessel extraction** is a bona fide record of the Mini Project work carried out by **AMRUTHA VV(MES20MCA-2007)** submitted to the APJ Abdul Kalam Technological University, in partial fulfillment of the requirements for the award of the Master of Computer Applications, under my guidance and supervision. This report in any form has not been submitted to any other University or Institution for any purpose.

Internal Supervisor(s) External Supervisor(s)

Head Of The Department

Acknowledgements

My endeavor stands incomplete without dedicating my gratitude to a few people who have contributed towards the successful completion of our project.I pay my gratitude to the Almighty for his invisible help and blessing for the fulfillment of this work.At the outset i express my heartful thanks to our guide Associate Professor Balachandran K P for his valuable guidance and supervision. I take this opportunity to express my profound gratitude to Mrs.Priya JD, as my project coordinator for her valuable support, timely advise and strict schedules to complete my project. I also grateful to all my teaching and non-teaching staff for their encouragement, guidance and whole-hearted support. Last but not least, I gratefully indebted to our family and friends, who gave us a precious help in doing our project.

AMRUTHA VV(MES20MCA-2007)

Abstract

Blood vessel in retina is an important component in finding the cardiovascular disease, ophthalmological disease and segmentation of vessel tree in retina is used for computerbased identification systems. It has been identified that in some cases the symptoms of some diseases such as Diabetic Retinopathy, Hemorrhages cannot be differentiated from that of the blood vessels while training the fundus images. The Image segmentation process is examined to increase the accuracy using debauched vessel segmentation method which will help us to remove the blood vessels from the fundus images and provides easy processing. The precise retinal vessel segmentation has been established and executed. The blood vessel extraction is an edge enhancement and detection algorithm are analyzed. It is suited for an abnormal retinal fundus image. It diagnoses the low vessel contrasts, drusen and exudates.

Keywords:EEED, Retina, Blood Vessel.Disease prediction,Pattern Recognition,CNN Algorithm,Image processing,Retinal disease Dataset,Machine learning

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Chapter 1

Introduction

1.1 Background

The background of the project is explained.Retina, different imaging techniques, and retinaldiseases are described.The Image segmentation process is examined to increase the accuracy using debauched vessel segmentation method which will help us to remove the blood vessels from the fundus images and provides easy processing. The blood vessel extraction is an edge enhancement and detection algorithm are analyzed.The Edge Enhancement and Edge detection method(EEED method) separates the surplus edges and does not consider the blood vessels.The method is faster and finds the good results,the significance of the method to these method is to improve the blood vessels contrast and diffuse the anomalous topographies in the retina image.The process involved in the EEED method is,First we input a retinal image. Then the retina image is convert into grayscale form, are often used for extracting descriptors instead operating on color images.and it reduces computational requirements. Then it is convolved with gaussian large bluring kernel to extract the blood vessels. The blurred image contains only the illumination pattern and other patterns get lost. the Gaussian blurred image is obtained from the retinal fundus image .this blurred image is given as an input to the log filter of a certain kernel size.then it will remove the noise and move blood vessel on images more clearly. The significance of log filter gives the uniform background intensity image.The image consists of higher intensity and maintain uniform intensity and is to be processed for cannial edage detection.It returns a single intensity threshold that seperates pixels into two classes,forground and background.through this we will get a cleared structure of blood ves-

sels.Then here we using algorithm is Convolution neural network(CNN).The blood vessel extracted images will be the trained using CNN.first we trained the system by giving image input from the datset.from already labeled images in the data set, we gives images as a input to the system.and it will extract the pixels and generate a pattern,the pattern will be,same disease are one pattern,normal ones are one pattern like.so the CNN model have the knowledge to analyse the patterns.and the user uploads an image , first it will convert in to gray scale then it go to guassian blurred method and cannial detection will preprocess it.and for detecting disease it will go two CNN and compare the images with the patterns and find the matching one and gives the corresponding output.CNN extracts the feature of image and convert it into lower dimensions without loosing its characteristics. The role of cnn is to reduce the images into a form which is easier to process,without losing features which are critical for getting good prediction.Each input layer is connected to the next hidden layer.CNN is mainly used in image recognition, object detection and segmentation.The output obtained is compared with dataset and then predict the result

The project was developed using Agile Development model.The entire project was divided into 4 sprints.In the first sprint,The table design,form design,basic coding are done.And in the second print,Obtaining Gaussian blurred image from retinal image,Preprocessing steps are done.And in the third sprint,Image classification,prediction through CNN Algorithm are done.In the fourth sprint,Testing data,and output generatioin are done.

1.1.1 Motivation

Blood vessel in retina is an important component in finding the cardiovascular disease, ophthalmological disease and segmentation of vessel tree in retina is used for computerbased identification systems. It has been identified that in some cases the symptoms of some diseases such as Diabetic Retinopathy, Hemorrhages cannot be differentiated from that of the blood vessels while training the fundus images.So here i propose this project as extract the blood vessels from the retinal image.so through this we can easily identify the retinal disease.And people can use this app from anywhere.therefore people can upload the fundus image while sitting in their home also and get fast result.If peoples identified their disease after many days left ,maybe it will cause them to eye blindness.so through this app we can easliy identify the disease and can take proper treatment.And this will help your eyes healthy.In this project peoples don't need to waste time by seeing doctor to detect disease.if there is no disease found it will waste of time to people.In this covid situation it will good peoples to reduce the hospital visit.Through this project they can check the disease in while sitting in their home and after disease predicted,they can directly go for consultation.

1.2 Objective

The objective of my paper is to remove the blood vessels from the input fundus image there by enabling us to identify the diseases easily .Blood vessel in retina is an important component in finding the cardiovascular disease, ophthalmological disease and segmentation of vessel tree in retina is used for computerbased identification systems. It has been identified that in some cases the symptoms of some diseases such as Diabetic Retinopathy,Hemorrhages cannot be differentiated from that of the blood vessels while training the fundus images. The Image segmentation process is examined to increase the accuracy using debauched vessel segmentation method which will help us to remove the blood vessels from the fundus images and provides easy processing.The blood vessel extraction is an edge enhancement and detection algorithm are analyzed. It is suited for an abnormal retinal fundus image. It diagnoses the low vessel contrasts, drusen and exudates.it can detect textural changes related to retinal diseaes as early as possible.The aim of the project is to develop a fully automated detection method for retinal image analysis and to detect retinal diseases.

1.3 Contribution

This project on diagnosing the identification of retinal disease has following main contributions:

1. This project would help to detect retinal diseases at the early stage, which is to prevent further deterioration of retinal health that leads to visual impairment and any other related health issues.

2. The fundamentals of designing CNN have been analysed in depth, and a novel architecture has been designed based on LeNet-5 architecture. The proposed model is a 13 layered CNN consisting of 5 Convolution layers, 3Max-pooling layers, 3 Batch normalization layers, 1 Rectified Liner Unit(ReLu) layer, and 1 Fully Connected layer for detecting retinal diseases. This proposed model is computationally inexpensive and efficient in diagnosing retinal abnormalities related to DR and hemorrhages etc.

3. The hypothesis for designing CNN has been set and explained how image size, filter size, parameters, and hyperparameters affect the size or deepness of CNN models.

4. A hypothesis has been set and proved, which says, It is possible to use simple yet effective CNN models for some particular tasks rather than using deep models; if the number of target class is not more than 5, it is better to use simple task specific CNN model to avoid complexity, computational, memory, and time cost

. 5. The proposed machine learning based method provides generalized model for diagnosing retinal blood vascular diseases, which is capable of differentiating disease with similar lesions. While the literature on retinal abnormality detection methods are individualistic, the proposed machine learning model has the potential to diagnose diseases. which make the model to stop the disease progression and prevent the blindness among the diabetes affected patients.

1.4 Report Organization

Write your project report structure.

(Sample) The project report is divided into four sections. Section 2 describes literature survey. Section 3 describes the methodology used for implementing the project. Section 4 gives the results and discussions. Finally Section 5 gives the conclusion.

Chapter 2

Literature Survey

.**D. H. Friedman[1969]**,has proposed a variety of blood vessel extraction (BVE) techniques exist in the literature, but they do not always lead to acceptable solutions especially in the presence of anomalies where the reported work is limited. Four techniques are presented for BVE: (1) BVE using Image Line Cross-Sections (ILCS), (2) BVE using Edge Enhancement and Edge Detection (EEED), (3) BVE using Modified Matched Filtering (MMF), and (4) BVE using Continuation Algorithm (CA). These four techniques have been designed especially for abnormal retinal images containing low vessel contrasts, drusen, exudates, and other artifacts. The four techniques were applied to 30 abnormal retinal images, and the success rate was found to be (95 to 99)percentage for CA.Investigations revealed that the four techniques in the order of increasing performance could be arranged as ILCS, MMF, EEED, and CA. Here we demonstrate these four techniques for abnormal retinal images only. ILCS, EEED, and CA are novel additions whereas MMF is an improved and modified version of an existing matched filtering technique. CA is a promising technique.

W. E. Hart, M. Goldbaum, B. Cote, P. Kube, and M. R. Nelson[1997],has proposed Automatic measurement of blood vessel tortuosity is a useful capability for automatic ophthalmological diagnostic tools. We describe a suite of automated tortuosity measures for blood vessel segments extracted from RGB retinal images. The tortuosity measures were evaluated in two classification tasks: (1) classifying the tortuosity of blood vessel segments and (2) classifying the tortuosity of blood vessel networks.

S. Chaudhuri, S. Chatterjee, N. Katz, M. Nelson, and M. Goldbaum[1989] has propoes Blood vessels usually have poor local contrast, and the application of existing edge detection

algorithms yield results which are not satisfactory. An operator for feature extraction based on the optical and spatial properties of objects to be recognized is introduced. The gray-level profile of the cross section of a blood vessel is approximated by a Gaussian-shaped curve. The concept of matched filter detection of signals is used to detect piecewise linear segments of blood vessels in these images. Twelve different templates that are used to search for vessel segments along all possible directions are constructed. Various issues related to the implementation of these matched filters are discussed. The results are compared to those obtained with other methods.

Chapter 3

Methodology

3.1 Introduction

The Image segmentation process is examined to increase the accuracy using debauched vessel segmentation method which will help us to remove the blood vessels from the fundus images and provides easy processing. The precise retinal vessel segmentation has been established and executed. The blood vessel extraction is an edge enhancement and detection algorithm are analyzed.The Edge Enhancement and Edge detection method(EEED method) separates the surplus edges and does not consider the blood vessels.The method is faster and finds the good results,the significance of the method to these method is to improve the blood vessels contrast and diffuse the anomalous topographies in the retina image.The process involved in the EEED method is,First we input a retinal image. Then the retina image is convert into grayscale form, are often used for extracting descriptors instead operating on color images.and it reduces computational requirements. Then it is convolved with gaussian large bluring kernel to extract the blood vessels. The blurred image contains only the illumination pattern and other patterns get lost. the Gaussian blurred image is obtained from the retinal fundus image .this blurred image is given as an input to the log filter of a certain kernel size.then it will remove the noise and move blood vessel on images more clearly. The significance of log filter gives the uniform background intensity image.

3.2 Modules

The project is divided into 2 functional modules.They are,

1.Expert System

- Login

  Admin login to the website to manage users

- View feedback

  Admin can view feedback from registered users.

- Addmanage treatments

  Admin adds treatments about different retinal disease.

2.User

- Registration

  User can register with this app.

- Login

  User can login with the registered userid and password.

- View tips

  User can view the tips added by admin.

- View treatments

  User can view the treatment added by admin.

- Upload imageview result

  User can upload retinal image and user can get the result.

- Send feedback

  User can send feedback to admin,about the experience of using this app.

- Logout

  User can logout.

3.3 Developing Enviornment

- OPERATING SYSTEM : WINDOWS 10
- FRONT END : HTML, CSS, JAVASCRIPT
- BACK END : MySQL
- Dataset: Retinal disease Dataset from Kaggle website is used
- IDE : JetBrains PyCharm, Android studio
- TECHNOLOGY USED : PYTHON,JAVA
- FRAME WORK USED : Flask

3.4 Work Flow

A retina image is convolved with gaussian large blurring kernel to extract the blood vessels. The blurred image contains only the illumination pattern and other patterns get lost. If the Gaussian blurred image is obtained from the retinal fundus image, the other image can be formed in two stages. The final image is the miniature of two images. The intensity in the lower range only is illuminated in a blood vessels of retinal fundus image. The blood vessels are having the lowest values with increased edges when compared to the background in aminimum image. In the minimum image background, diffusion suppression takes place of the drusen disease in the disc of optics retina. This image gets blurred by using gaussian blurring method of less kernel size. This algorithm is used to maintain the continual process in the vessel tree for broken pieces. This blurred image is given as an input to the log filter of a certain kernel size. This final image is processed with contrast enhanced and reversed technique with vessel trees and it should be prominent one. This image has a uniform background image. This image consists of noise component when compared with the vessel tree contrast component, in turn the noise component will also be increased.. The significance of log filter gives the uniform background intensity image. This feature resembles like homomorphic filtered image feature. The image consists of higher intensity and maintains uniform intensity and is to be processed for OTSU's optimum thresholding. The filtered image is converted into binary image. This binary image has the noise component. The noisy images consist of more noise components and small noise components of a OTSUs images. Figure explains the process involved in EEED method.

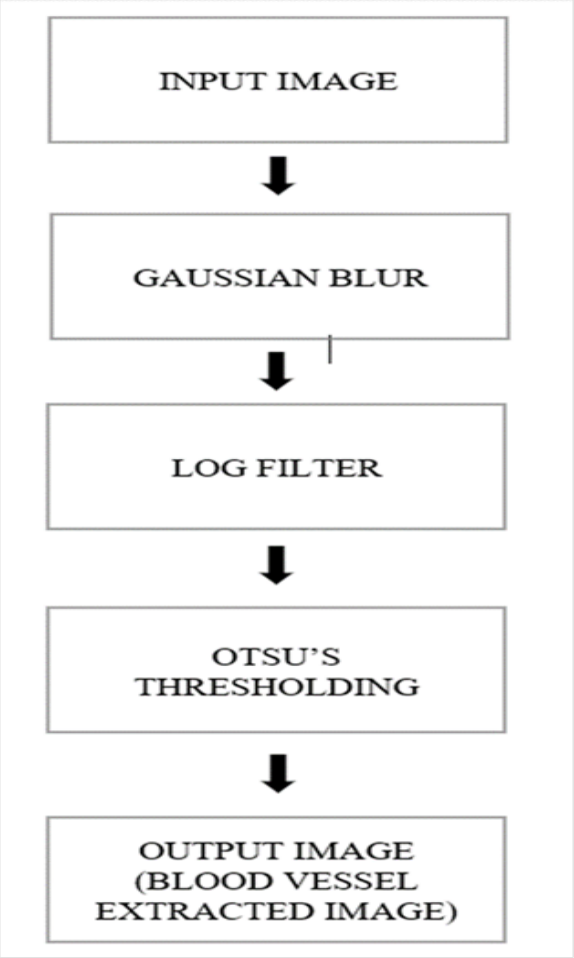

Figure 3.1: work flow

3.5 CNN Algorithm

Here using algorithm is Convolution neural network(CNN).The blood vessel extracted images will be the trained using CNN.first we trained the system by giving image input from the datset. from already labeled images in the data set, we gives images as a input to the system.and it will extract the pixels and generate a pattern,the pattern will be,same disease are one pattern,normal ones are one pattern like.so the CNN model have the knowledge to analyse the patterns.and the user uploads an image , first it will convert in to gray scale then it go to guassian blurred method and cannial detection will preprocess it.and for detecting disease it will go two CNN and compare the images with the patterns and find the matching one and gives the corresponding output.There are multiple convolutional layers extracting features from the image and finally the output layer. CNN extracts the feature of image and convert it into lower dimensions without loosing its characteristics. The role of cnn is to reduce the images into a form which is easier to process,without losing features which are critical for getting good prediction. Each input layer is connected to the next hidden layer. CNN is mainly used in image recognition, object detection and segmentation The output obtained is compared with dataset and then predict the result.

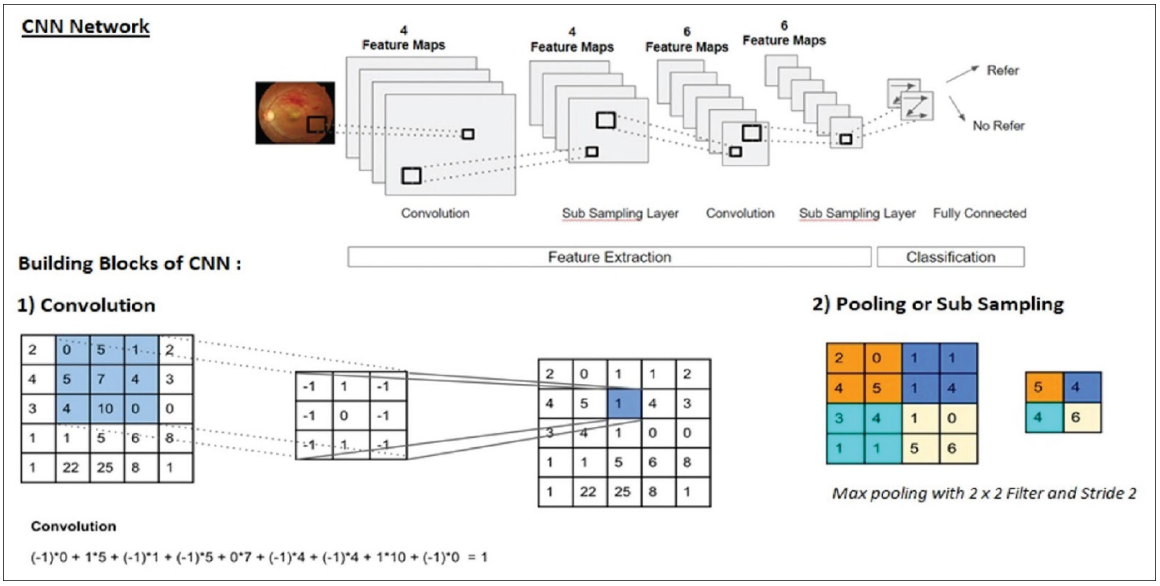

Figure 3.2: CNN Algorithm work flow

3.6 User stories

A key component of agile software development is putting people first, and user-stories put actual end users at the center of the conversation. A user story is a tool used in agile software development to capture a description of a software feature from an end-user perspective. The user story describes the type of user, what they want and why. A user story helps to create a simplified description of a requirement. The user story of project is given in Table 3.3

UserStoryID	As a <type of user>	I want to <perform some task>	So that I can <Achieve some goal>
1	Expert	login	login successful with correct username and password
2	Expert	Add and manage dataset	Add disease effected fundus image.
3	Expert	Add and manage tips	Add tips for users and view the added tips.
4	Expert	View feedback	View user feedback
5	Expert	Add and Manage treatments	Add treatments for different eye disease.
6	User	Register	User can register with this app
7	User	Login	login successful with correct username and password
8	User	Upload image and view result	Upload image and View result
9	User	View tips	View added tips
10	User	Send feeback	Send feedback to admin
11	User	View treatments	View added treatments

Figure 3.3: User story

3.7 Project plan

A project plan that has a series of tasks laid out for the entire project, listing task durations, responsibility assignments, and dependencies.The project plan is given in Table 3.4

User Story ID	Task Name	Start Date	End Date	Days	Status
1	Sprint 1	26/12/2021	28/12/2021	2	Completed
2		29/12/2021	31/12/2021	3	Completed
3		03/12/2021	08/01/2022	5	Completed
4	Sprint 2	09/01/2022	13/01/2022	5	Completed
5		14/01/2022	18/01/2022	5	Completed
6	Sprint 3	19/01/2022	23/01/2022	5	Completed
7		03/01/2022	07/02/2022	5	Completed
8	Sprint 4	08/02/2022	12/01/2022	5	Completed

Figure 3.4: Project plan

The project has 4 sprints:

1.Sprint 1:

In the first sprint table,form,basic design coding is completed.

2.Sprint 2:

In the second sprint obtaining guassian blurred image from retinal image and preprocessing steps are completed.

3. Sprint 3:

In the third sprint image classification and prediction are completed.

4.Sprint 4:

In the fourth sprint testing data and ouput generation are done.

3.8 Product backlog

A product backlog is a list of the new features, changes to existing features, bug fixes,infrastructure changes or other activities that a team may deliver in order to achieve a specific outcome.The product backlog is the single authoritative source for things that a team works on.The product backlog of the project is given in Table 3.5

User Story ID	Priority <High/Medium/Low>	Size (Hours)	Sprint <#>	Status <Planned/In progress/Completed>	Release Date	Release Goal
1	Medium	2	1	Completed	08/01/2022	Table design
2	High	3		Completed	08/01/2022	Form design
3	High	5		Completed	08/01/2022	Basic coding
4	High	5	2	Completed	13/01/2022	Obtaining Gaussian blurred image from retinal image
5	Medium	5		Completed	18/01/2022	Preprocessing
6	High	5	3	Completed	23/01/2022	Image classification
7	Medium	5		Completed	07/02/2022	Prediction
8	Medium	5	4	Completed	12/01/2022	Testing data
9	High	5		Completed	20/02/2022	Output generation

Figure 3.5: Product backlog plan

3.9 Sprint Backlog Plan

The sprint backlog is a list of tasks identified by the Scrum team to be completed during the Scrum sprint. During the sprint planning meeting, the team selects some number of product backlog items, usually in the form of user stories, and identifies the tasks necessary to complete each user story.It is, how many hours each task will take someone to complete.

Backlog Item `	Status & completion date	Original estimate in hours	Day1	Day2	Day3	Day4	Day 5	Day6	Day7	Day8	Day9	Day10	Day11	Day12	Day13	Day14
User story #1,#2,#3,		hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table design	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form design	31/12/2021	3	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Basic coding	08/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #4,#5																
Obtaining Gaussian blurred image from retinal image	13/01/2022	5	1	1	1	0	0	1	1	0	0	0	0	0	0	0
Preprocessing	18/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #6,#7																
Image classification	23/01/2022	5	5	1	1	1	1	0	0	0	0	0	0	0	0	0
prediction	07/02/2022	5	0	0	0	0	0	2	1	2	0	0	0	0	0	0
User story #8,#9																
Testing data	12/02/2022	5	0	0	0	0	0	0	0	1	1	2	1	0	0	0
Output generation	20/02/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
Total		40	3	3	2	2	2	4	2	3	1	4	3	4	4	3

Figure 3.6: Sprint backlog plan

3.10 Sprint Actual

Actual sprint backlog is what adequate sprint planning is actually done by project team there may or may not be difference in planned sprint backlog. The detailed sprint backlog (Actual)is given below.

Backlog Item	Status & completion date	Original estimate in hours	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day 8	Day9	Day10	Day11	Day12	Day13	Day14
User story #1,#2,#3,		hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table design	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form design	31/12/2021	3	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Basic coding	08/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #4,#5																
Obtaining Gaussian blurred image from retinal image	13/01/2022	5	1	1	1	0	0	1	1	0	0	0	0	0	0	0
Preprocessing	18/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #6,#7																
Image classification	23/01/2022	5	0	0	0	2	0	1	0	1	0	0	0	0	1	0
prediction	07/02/2022	5	0	0	0	0	0	2	1	2	0	0	0	0	0	0
User story #8,#9																
Testing data	12/02/2022	5	0	0	0	0	0	0	0	1	1	2	1	0	0	0
Output generation	20/02/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
Total		40	2	2	1	3	1	5	2	4	1	4	3	4	5	3

Figure 3.7: Sprint actual

Chapter 4

Results and Discussions

4.1 Datasets

There are different databases that are available for the fundus image of the eye. The data set used for the training and testing of the system was collected from kaggle site.And here The total data is 400 from which 320 samples randomly chosen and used as training patterns and tested with 80 instances of the same data set. The data set consist of evenly distributed men and women. Samples also consider age randomly collected from 18 years to 70 years.

4.2 Results

The retinal fundus image for vessel tree extraction EEED method.processes the image first we convert it to gray scale. This image is convolved with a Gaussian blurring kernel of the standard deviation = 24, represents the blurred image. This image is given as an input of the gaussian kernel of the standard deviation is one. It aids to cultivate steadiness in the tree vessel structure or otherwise wrecked or we can say the corresponding pixels can be lost in the binary vessel tree can be perceived. The threshold fining can be measured and does not provide a vessel tree in a suitable manner. It is due to the fact that the illumination background is not in uniform. In order to avoid this problem.Log kernel size of nine x nine matrix has been convolved and the results are shown.It is then inverted using blood vessels consists of bright concentrations and edges are considered to be brighter. The finest value of threshold is calculated and hence the binary image is obtained. This binary image noise component is not available in vessel tree. If still noise component is present, the length filtering is used to eliminate the binary noise. The window size eight x eight has been selected and the removal of noise has been implemented and the resultant image is represented.The sixteen x sixteen window size has been chosen and it should be prominent one. This image has a uniform background image. This image consists of noise component when compared with the vessel tree contrast component,in turn the noise component will also be increased. The vessels boundaries now look like a bright boundary with dark edges due to applying the concept of contrast reversal technique. It is an exact feature appears due to the log filter appliance. The significance of log filter gives the uniform background intensity image. This feature resembles like homomorphic filtered image feature. The image consists of higher intensity and maintain uniform intensity and is to be processed for OTSU's optimum thresholding. The filtered image is converted into binary image.This binary image has the noise component. The noisy images consist of more noise components and small noise components of a OTSUs images. The noise component in the binary image is eliminated using a length filtering method. The proposed algorithm window size can vary from four to sixteen. Pixel values can be added together in the boundary of the window. Whenever.the pixel values are zero, then the corresponding pixels are eliminated. The final image consists only vessel tree structure.

4.3 Screenshots

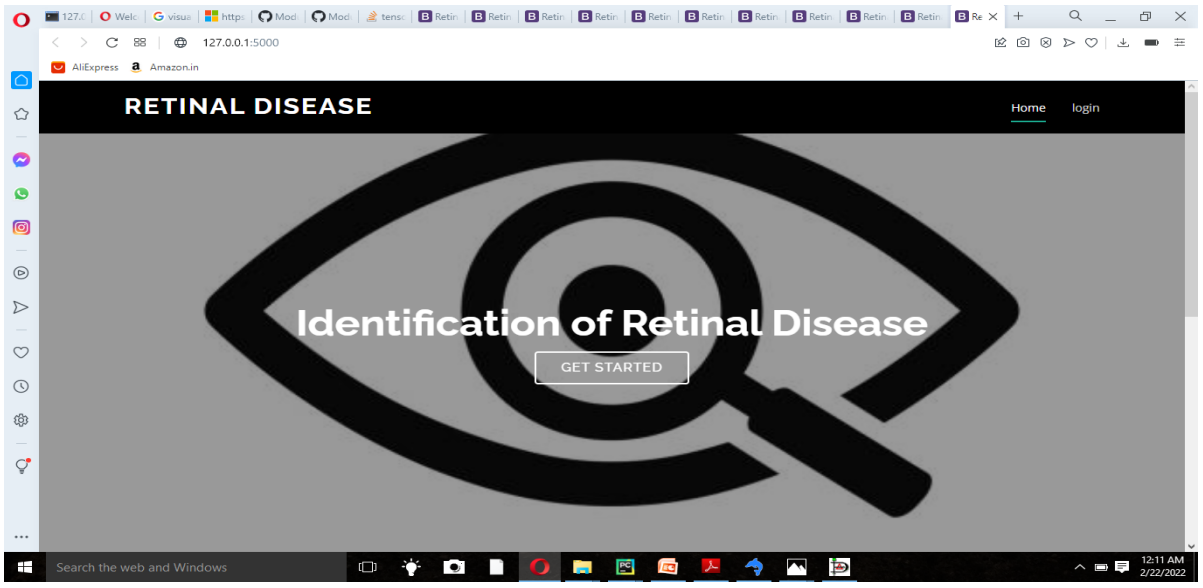

Figure 4.1: Home page

4.4 Screenshots

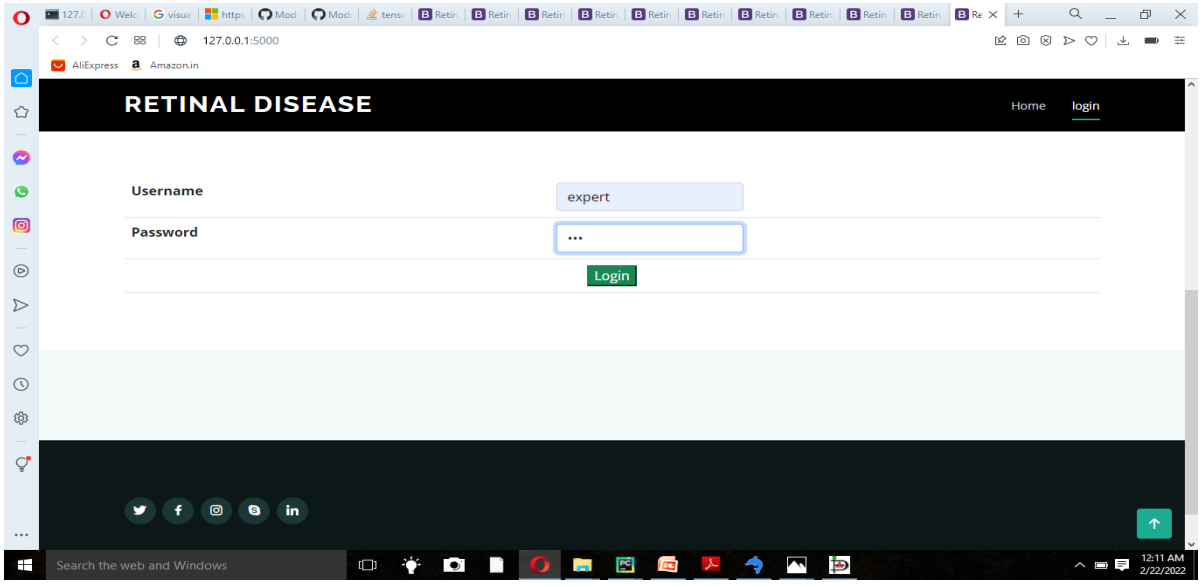

Figure 4.2: Login page

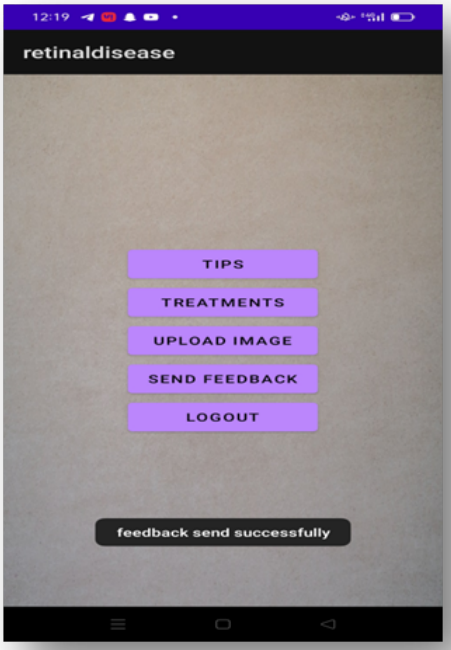

Figure 4.3: Home page

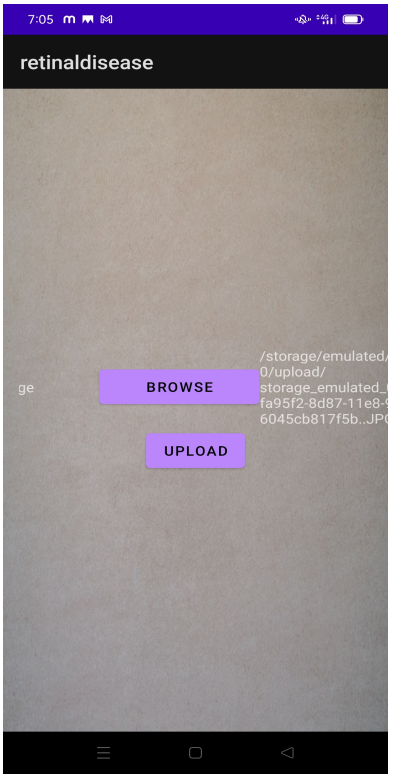

Figure 4.4: Upload image

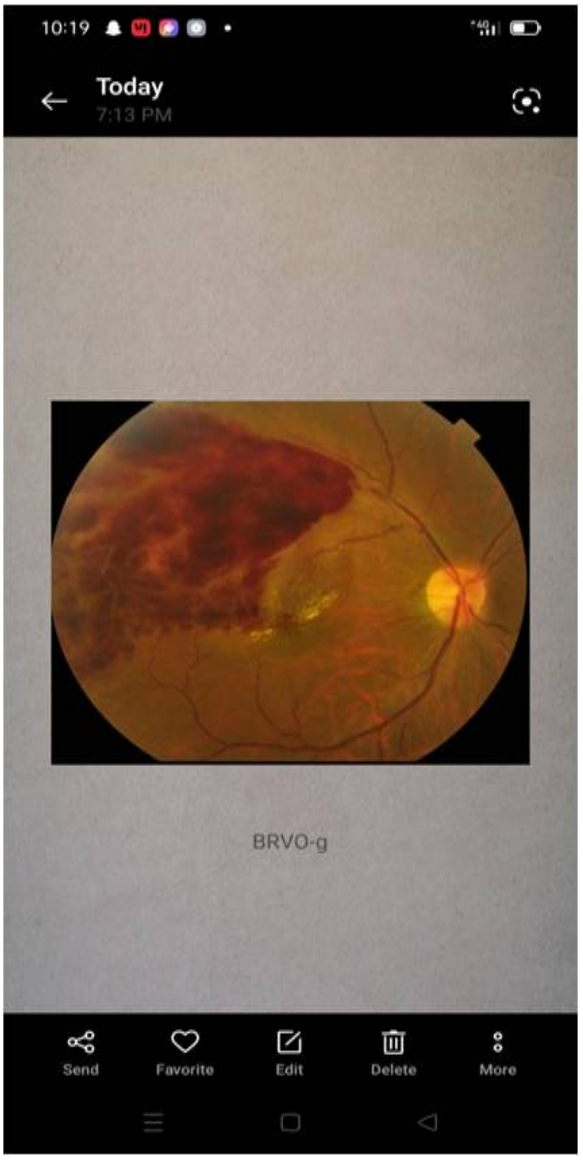

Figure 4.5: View result

Chapter 5

Conclusions

Algorithm for retinal fundus images. This algorithm analyzed very well for a small number of broken pieces of vessels. It is observed that the execution time is very less. It is also observed that this method outperforms excerpt binary vessel tree algorithm with noise. It is due to the fact that vessel part is also eliminated if we applied noise filtering. But EEED Algorithm eliminates noise component alone. It conserves thinner vessel segments too in the vessel trees. This method also working for low quality images. In this paper, the image with low quality and low contrast has been also analyzed. This method provides good results in the presence of anomalies by eliminating the noise and thinner vessels.

References

[1] **D. H. Friedman,** "Detection of signals by template matching," Johns Hopkins University Press, Baltimore, Md, USA, 1969.

[2] **S. Chaudhuri, S. Chatterjee, N. Katz, M. Nelson, and M. Goldbaum,** "Detection of blood vessels in retinal images using two-dimensional matched filters," IEEE Transactions on Medical Imaging, vol. 8, no. 3, pp. 263–269, 1989.

[3] **R. J. Vidmar,** "On the use of atmospheric plasmas as electromagnetic reflectors," IEEE Transaction on Plasma Science, vol. 21, no. 3, pp. 876– 880, 1992.

[4] **W. E. Hart, M. Goldbaum, B. Cote, P. Kube, and M. R. Nelson,** "Automated measurement of retinal vascular tortuosity," in Proceedings of the AMIA Fall Conference, 1997.

[5] **A. Hoover,** "Locating blood vessels in retinal images by piecewise threshold probing of a matched filter response," IEEE Transactions on Medical Imaging, vol. 19, no. 3, pp. 203–210, 2000.

Appendix

Source Code

```
 //Webcode.py

from flask import *
import functools
app=Flask(__name__)
from dbconn import *
app.secret_key="hjvghvf"

@app.route('/')
def login():
   return render_template('/login.html')

def login_required(func):
   @functools.wraps(func)
   def secure_function():
      if "lid" not in session:
         return redirect ("/")
      return func()
   return secure_function


@app.route('/logincode',methods=['post'])
def logincode():
   uname=request.form['textfield']
   pwd=request.form['textfield2']
   qry="SELECT * FROM login WHERE username=%s AND PASSWORD=%s"
   val=(uname,pwd)
   print(val)
   res=selectone(qry,val)
   if res is None:
      return '''<script>alert('invalid');window.location="/"</script>'''
   else:
      if res[3]=='expert':
         session['lid']=res[0]
         return redirect('/experthome')
      else:
         return '''<script>alert('invalid');window.location="/"</script>'''


@app.route('/add_and_manage_treatment')
@login_required
def add_and_manage_treatment():

   qry="select* from treatment"
```

```
    res=selectall(qry)
    return render_template('add_and_manage_treatments.html',val=res)
@app.route('/dlttrtmnt')
@login_required

def dlttrtmnt():
    id=request.args.get('id')
    qry="delete from treatment where tid=%s"
    iud(qry,str(id))
    return '''<script>alert(' deleted');window.location="/add_and_manage_treatment#about"</script>'''


@app.route('/add_treatment',methods=['post'])
@login_required

def add_treatment():
    return render_template('add_treatment.html')

@app.route('/add_treatment1',methods=['post'])
@login_required

def add_treatment1():
    disease=request.form['textfield']
    trtmnt=request.form['textfield2']
    details=request.form['textarea']
    qry="insert into treatment values(NULL,%s,%s,%s,curdate())"
    val=(disease,trtmnt,details)
    iud(qry,val)

    return '''<script>alert('added');window.location="/add_and_manage_treatment#about"</script>'''

@app.route('/addtips',methods=['post'])
@login_required

def addtips():
    return render_template('addtips.html')

@app.route('/addingtips',methods=['post'])
@login_required

def addingtips():
    tips=request.form['textarea']
    qry="INSERT INTO tips VALUES(NULL,%s,CURDATE())"
    iud(qry,tips)
    return '''<script>alert('tip added');window.location="/tips#about"</script>'''


@app.route('/experthome')
@login_required

def experthome():
    return render_template('experthome.html')


@app.route('/tips')
@login_required

def tips():
    qry="SELECT * FROM `tips`"
    res=selectall(qry)
    return render_template('tips.html',val=res)

@app.route('/dlttips')
```

Appendix

```
@login_required

def dlttips():
    id=request.args.get('id')
    qry="delete FROM `tips` where tip_id=%s"
    iud(qry,str(id))
    return '''<script>alert('tip deleted');window.location="/tips#about"</script>'''


@app.route('/viewfeedback')
@login_required

def viewfeedback():
    qry="SELECT `registration`.`fname`,`registration`.`lname`,`registration`.`email`,`feedback`.* FROM `registration` JOIN
        `feedback` ON `registration`.`lid`=`feedback`.`lid`"
    res=selectall(qry)
    return render_template('viewfeedback.html',val=res)

@app.route('/logout')
def logout():
    session.clear()
    return render_template('login.html')
    app.run(debug=True)


//Android
    from flask import*
from src.dbconn import *
app=Flask(__name__)
import os
from werkzeug.utils import secure_filename

@app.route('/login',methods=['post'])
def login():
    uname = request.form['uname']
    pswd = request.form['pass']
    qry="select * from login where username=%s and password=%s and type='user' "
    val=(uname,pswd)
    # print(val)
    res=selectone(qry,val)
    if res is None:
        return jsonify({'task': "invalid"})

    else:
        return jsonify({'task': "valid",'id': res[0]})


@app.route('/reg', methods=['post'])
def reg():
    try:
        fname=request.form['fname']
        lname=request.form['lname']
        place=request.form['place']
        post=request.form['post']
        pin=request.form['pin']
        gender=request.form['gender']
        phone=request.form['phone']
        email=request.form['email']
        uname=request.form['uname']
        pswd=request.form['pswd']
        qry="insert into login values(NULL,%s,%s,'user')"
        val=(uname,pswd)
        id=iud(qry,val)
```

```
        qry1="insert into registration values(NULL,%s,%s,%s,%s,%s,%s,%s,%s,%s)"
        val1=(str(id),fname,lname,gender,place,post,pin,phone,email)
        iud(qry1,val1)
        return jsonify({'task':'success'})
    except Exception as e:
        return jsonify({'task': 'already exist'})


@app.route('/sndfeedback', methods=['post'])
def sndfeedback():
    lid=request.form['lid']
    feedback=request.form['feedback']
    qry="insert into feedback values(NULL,%s,curdate(),%s)"
    val=(feedback,lid)
    iud(qry,val)
    return jsonify({'task':'success'})
@app.route('/viewtips', methods=['post'])
def viewtips():
    qry="select*from tips"
    res=androidselectallnew(qry)
    return jsonify(res)

@app.route('/viewtreatments', methods=['post'])
def viewtreatments():
    qry="select*from treatment"
    res=androidselectallnew(qry)
    return jsonify(res)


@app.route('/uploadimage',methods=['post'])
def uploadimage():

    image=request.files['file']
    im= secure_filename(image.filename)
    image.save(os.path.join("static/uploads", im))
    lid=request.form['lid']
    from src.newcnn import predictcnn
    res = predictcnn(os.path.join("static/uploads",im))
    print("ressssssssssss",res)
    qry="select * from dataset where `dateset_id`=%s"
    reslt=selectone(qry,res)
    if reslt is None:
        result="invalid"
    else:
        result=reslt[1]+"-"+reslt[2]
    qry="INSERT INTO `upload` VALUES(NULL,%s,%s,%s,curdate())"
    val=(lid,result,im)
    iud(qry,val)
    return jsonify({"task":result,'img':im})



app.run(host="0.0.0.0",port="5000")
```

Database Design

Attribute name	Datatype	Length	Description
Lid	Integer	11	Primary Key
Username	Varchar	25	
password	varchar	25	
type	varchar	25	

Table A.1: Login

Attribute name	Datatype	Length	Description
fid	Integer	11	Primary Key
feedback	Varchar	20	
date	date		
lid	Integer	11	

Table A.2: feedback

Attribute name	Datatype	Length	Description
tid	Integer	11	Primary Key
disease	Varchar	25	
treatment	varchar	50	
details	varchar	50	
date	date	50	

Table A.3: treatment

Attribute name	Datatype	Length	Description
uid	Integer	11	Primary Key
lid	int	11	
fname	varchar	25	
lname	varchar	25	
gender	varchar	25	
place	varchar	25	
post	varchar	25	
pin	Integer	11	
phone	bigint	20	
email	varchar	25	

Table A.4: Registration

Attribute name	Datatype	Length	Description
upload$_id$	Integer	11	Primary Key
user$_id$	Integer	25	
result	varchar	50	
image	varchar	50	
date	date		

Table A.5: Upload

Attribute name	Datatype	Length	Description
tip$_id$	Integer	11	Primary Key
tips	varchar	50	
date	date		

Table A.6: Tips

Dataflow Diagram

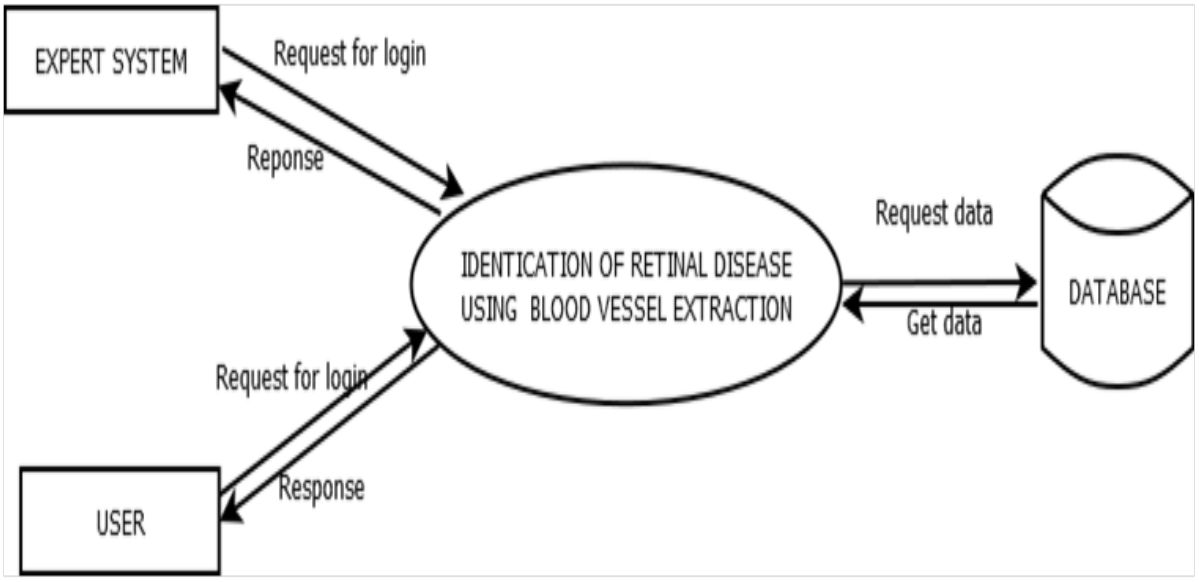

Figure A.1: Level 0

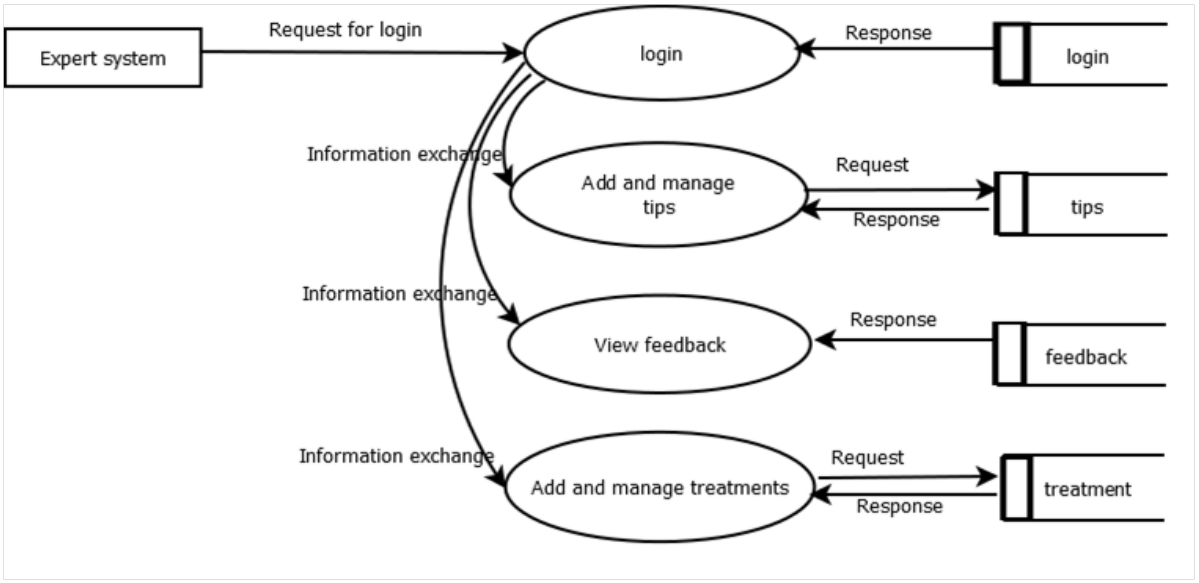

Figure A.2: Level 1

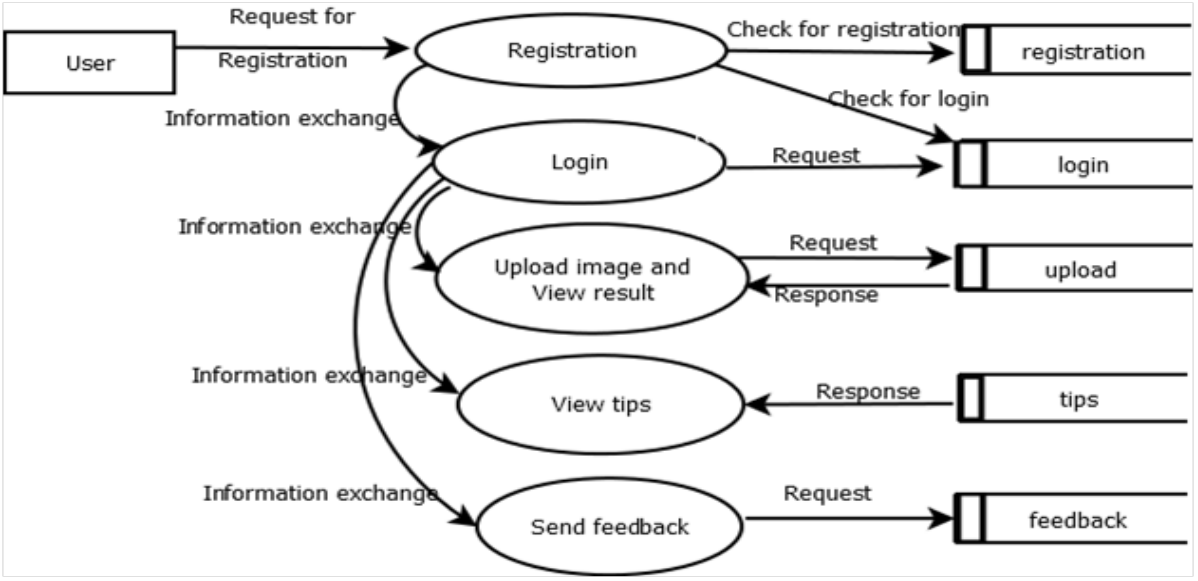

Figure A.3: Level 2